# New Directions 6/05

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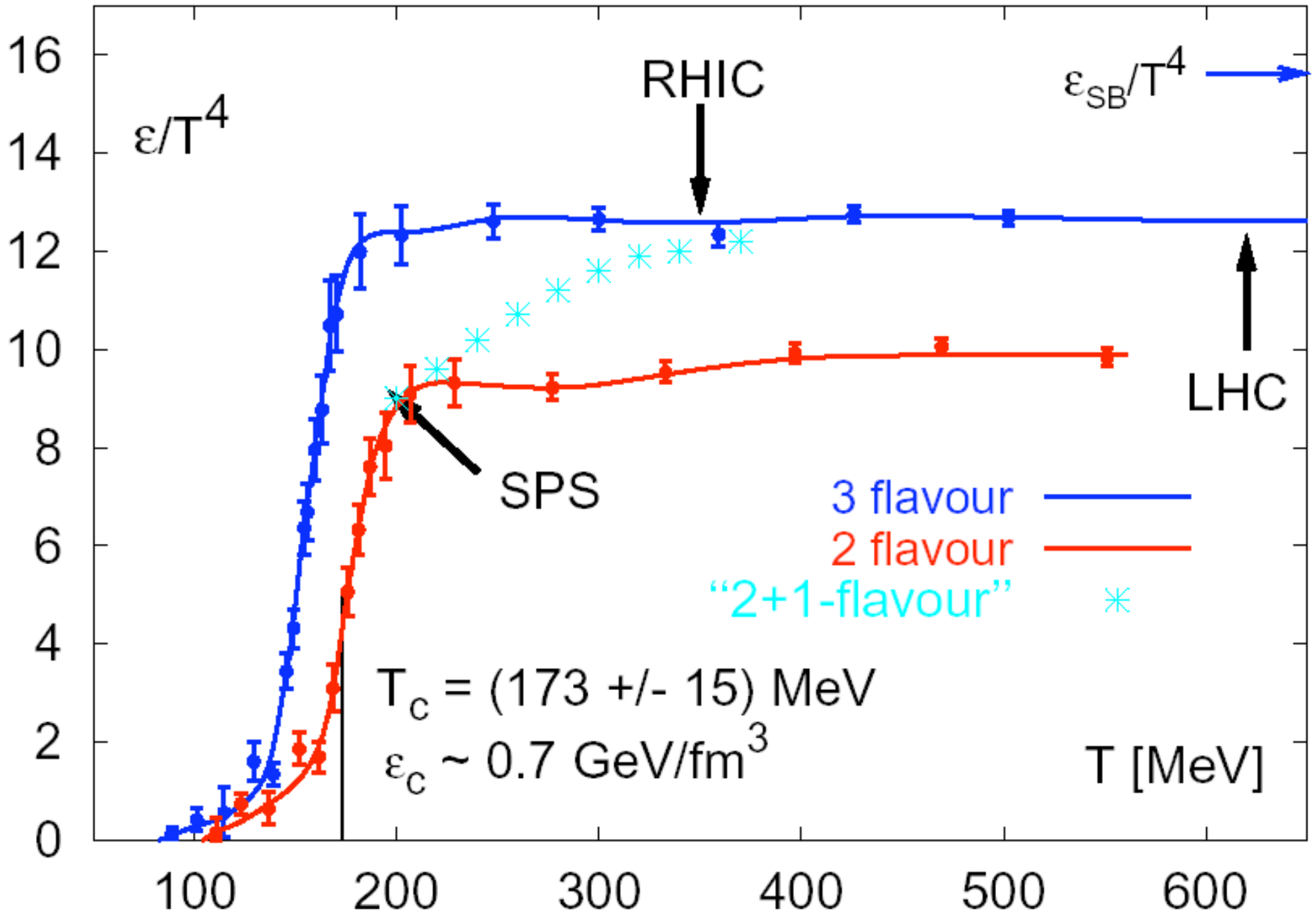
# Progress since April

- Active discussion on the rhicii-new-l list
  - http://lists.bnl.gov/pipermail/rhicii-new-l/
- Several interesting threads
  - The "s" in sQGP
    - More details, based on Jamie's question slides: http://up.colorado.edu/~nagle/Posting/sqgp_questions2.pdf
- Excellent participation so far

# Discussion Today

- "New Directions" meeting this morning:
  - Steinberg, Nagle, Seto, Pisarksi, Karsch, Petreczky, Shuryak, Roland, Trainor, Stankus, Steadman, Greene, Bickley, etc.
- Main topic
  - Has the shift to an sQGP led to a real "paradigm shift" that necessitates new questions about what we do?
- Harder than it looks...

# The Old Regime




N=4 SYM or HTL? (Shuryak vs. Karsch)

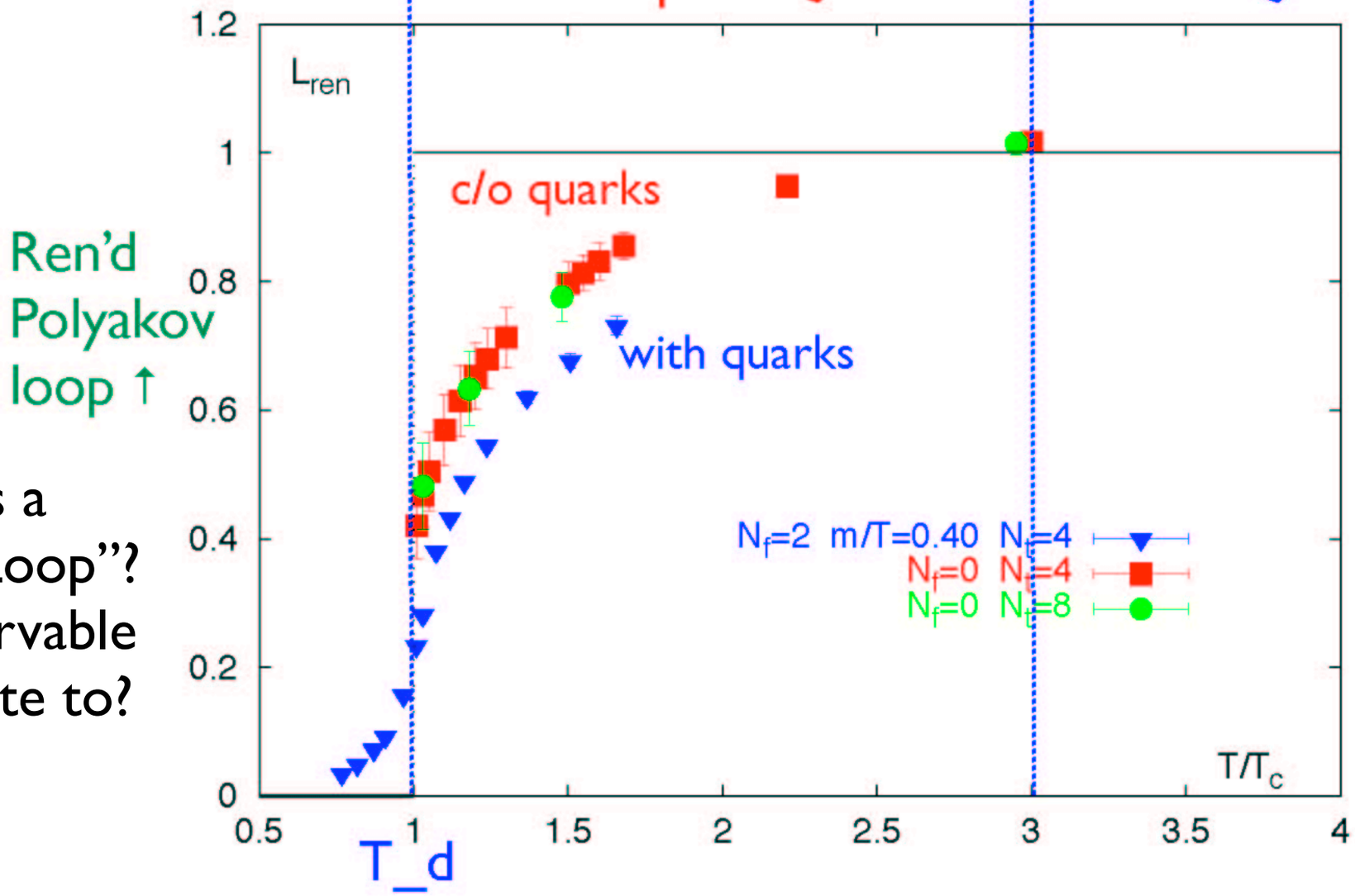
# Regime Change

*Non*-perturbative QGP

Ren'd Polyakov loop: = 0 in confined phase, =1 in pert. thy

Lattice: Z(3) sym. approx in QCD. Loop only near 1 above 3 T_d

<= Confined =><= *Non*-pert. QGP =><= Pert. QGP =>




Ren'd Polyakov loop ↑

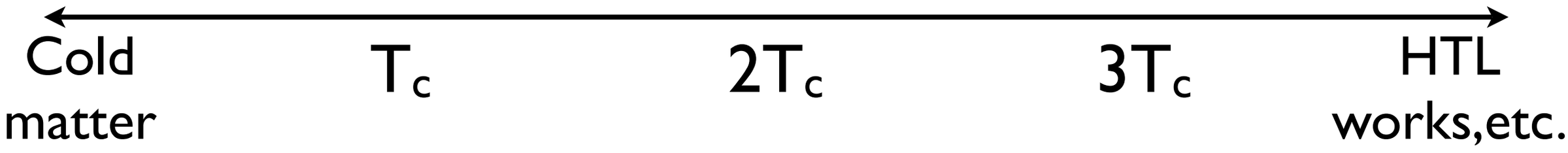
Bielefeld: lat/0312015

Two flavors, kaon masses

What is a "Polyakov Loop"? What observable does it relate to?

T/T_d=>

# 0,1,2,3...∞




Hadrons

Bound States

Quasi-particles (massive q and g)

What is the fundamental difference between these two concepts? (quantum numbers?)

# "Correlation Structure"

- Are we moving continuously from hadrons→colored bound states→quasiparticles →free quarks?
  - How do we see the difference between them
- Is there a phase transition? (PP: there never was...)
- Does the persistence of "hadronic" correlations weaken the interest in "QGP" studies (i.e. are we never to q&g?)
  - Stankus: no, these are a whole new spectrum!
- In general, we should never be afraid of where this reasoning may lead.

# Shuryak Bound States

- Shuryak's point of view is that the bound states are moderately large, so coupling constant from lattice applies to thinking
- He also claims that lattice "sees" the bound states already, despite claims from lattice people that they don't
- Some agreement that the *concreteness* of a new spectrum of "colored hadron" states provides some framework for progress

# Pre-thermal Physics

- Stankus: The great mystery of the field is not the behavior of the system after it is thermalized (flow, etc.), but how it got that way
- Thermalization of heavy particles was a topic of clear interest (Teaney)
- General issue of entropy production clearly fundamental, but little guidance so far

# What to Measure

- Beyond spectrum of SBS sQGP paradigm is surprisingly mute
- General guidance from theorists
  - More rapidity coverage, more PID, dileptons, onia
  - In other words, sQGP has not replaced pQCD as a theoretical framework good for calculations.
  - But a paradigm shift seems to have occurred...

# Old and New Questions

- Deconfinement probed by J/ψ
  - Lattice data has made interpretation of J/ψ more complex. Not just about screening length anymore but more generic modifications to HQ potential
- Thermal photons probed by dileptons
  - Peaks in the dilepton spectra from colored bound states
- Bulk thermalization
  - Plasma instabilities leading to rapid isotropization - will this create "filamentation" of rapidity distributions with a characteristic scale?
- "Old" observables may connect to newer questions

# Concerns

- We had a lot of people in the room for 3 hours and nothing *conclusive* emerged
- The field is either "dead" or in a period of rapid conceptual change out of which new questions may emerge
- We should be careful of designing a program for RHIC II which *only* addresses questions that existed before RHIC

# 5 Years

http://www.boingboing.net/2005/04/11/popularity_of_using_.html

**Monday, April 11, 2005**

**Popularity of using "in five years" to predict near-magic technology**
sebb says: "Why is this story not the biggest story in the media right now??!!?? (Cure for Cancer Within Five Years) Surely the best news of the millenium so far. A cure for cancer! all cancer! Posted as a side article on bbc news april 8th."
Whenever I read an article about a cure for peanut allergies (my daughter has a life threatening nut allergy), the articles always quote some researcher as saying it'll happen "in five years."

Curious about the popularity of "in five years," I googled the following terms:
"in two years" -- 1,320,000 results
"in five years" -- 1,420,000
"in ten years" -- 584,000
"in fifteen years" -- 59,000
"in twenty years" -- 176,000
"in fifty years" -- 74,300
"in a hundred years" -- 77,500
"in a thousand years" -- 56,300
...
"never" -- 296,000,000
"Never" wins by a huge margin, but "in five years" comes in second.
UPDATE: "in one year" barely beats "in five years" -- 1,490,000